

Six New Records of Hydroptilidae (Trichoptera) from Korea

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ABSTRACT

In the microcaddisfly family Hydroptilidae, only 12 species belonging to four genera are known currently from the Korean Peninsula. Yet, worldwide this family is one of the biggest of the Trichoptera families. Collection from 2015 to 2017 by aerial sweeping and light-trapping in the southeastern part of Korean Peninsula (Gyeongsangbuk-do and Gyeongsangnam-do) included species not recorded previously from the Korean Peninsula. We provide re-descriptions of the six species (*Hydroptila dampfi* Ulmer, 1929, *H. introspinata* Zhou and Sun, 2009, *Orthotrichia costalis* (Curtis, 1834), *O. tragetti* Mosely, 1930, *Oxyethira miea* Oláh and Ito, 2013, and *Stactobia nishimotoi* Botosaneanu and Nozaki, 1996) to improve comprehension of Korean hydroptilids.

Keywords: *Hydroptila*, *Orthotrichia*, *Oxyethira*, *Stactobia*, redescription, illustration

INTRODUCTION

The family Hydroptilidae Stephens, 1836 is a large family including over 2,000 species in the world (Holzenthall et al., 2015), 62 species in China (Yang et al., 2005; Zhou et al., 2009a, 2009b, 2010, 2016), and 54 species in Japan (Ito, 2018). However, knowledge of this family in Korea is quite poor; undoubtedly they have been ignored because of their small body size. Until this present time, only 12 hydroptilid species belonging to four genera were known from the Korean Peninsula: eight species of *Hydroptila* Dalman, 1819, two species of *Oxyethira* Eaton, 1873, and one species of *Stactobia* McLachlan, 1880 were recorded from North Korea (Botosaneanu, 1970; Kumanski, 1990). Only one species, *Orthotrichia coreana* Ito and Park, 2016, was recorded from South Korea (Ito and Park, 2016). Here, we examine specimens collected from the southeastern part of the Korean Peninsula, collected from a variety of habitats including streams, marshes, and big reservoirs (Fig. 1). Collections from these sites included six hydroptilid species not previously recorded from Korea. In this paper, we provide re-descriptions and illustrations of these species, thus making them readily available to local researchers and giving basic information for further study on local variations.

MATERIALS AND METHODS

Collections were made on three occasions in Gyeongsangnam-do and Gyeongsangbuk-do from 2015 to 2017, at sites shown in Fig. 1 and detailed in Table 1. The Unmuncheon Stream (Cheongdo-gun, Gyeongsangbuk-do), arising in the conserved and protected area between the northern slopes of Mt. Gajisan and Mt. Unmunsan, plays a role as a source of tap water. The Hobakso Valley (Miryang-si, Gyeongsangnam-do), running down the southern slope of Mt. Gajisan, is on the side opposite to the Unmuncheon Stream. Daepyeong Marsh (Haman-gun, Gyeongsangnam-do) is located near the Namgang River and, being designated as a natural monument, it is managed by local government. Junam Reservoir (Changwon-si, Gyeongsangnam-do) comprises three big reservoirs, Sannam, Junam, and Dongpan, and is famous as a sanctuary for migratory birds and for fishing. Aerial sweeping, light trapping, and UV pan light traps were used for collecting. All specimens are preserved in 80% ethanol, and genitalia were figured after treatment in dilute KOH. The voucher specimens for newly recorded Korean species will be deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Other specimens used in this study are deposited in Kyonggi University, Suwon, Ko-

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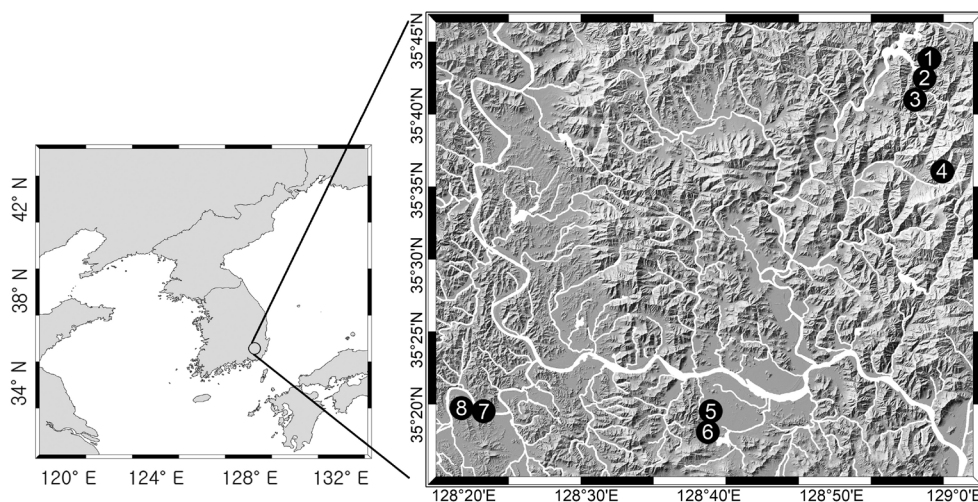


Fig. 1. Map showing sampling sites, Gyeongsangbuk-do and Gyeongsangnam-do, Korea.

Table 1. Geographical details for collection localities

Loc. No.	Locality	Latitude/Longitude (elevation)
1	Small tributary of Unmuncheon Stream, behind Ojin-ri Village Center, Ojin-ri, Unmun-myeon, Cheongdo-gun, Gyeongsangbuk-do, Korea	35°42'42.4"N, 128°58'31.4"E (163 m)
2	Ojin-1 Bridge, Unmuncheon Stream, Ojin-ri, Unmun-myeon, Cheongdo-gun, Gyeongsangbuk-do, Korea	35°42'13.9"N, 128°58'19.3"E (170 m)
3	Unmun Camping Area, Unmuncheon Stream, Sinwon-ri, Unmun-myeon, Cheongdo-gun, Gyeongsangbuk-do, Korea	35°40'42.6"N, 128°57'29.0"E (199 m)
4	Upper stream of Hobakso Valley, Mt Gajisan, Nammyeong-ri, Sannae-myeon, Miryang-si, Gyeongsangnam-do, Korea	35°35'44.6"N, 128°59'37.5"E (498 m)
5	Junam Reservoir, Dongeup-ro 747, Uchiang-gu, Changwon-si, Gyeongsangnam-do, Korea	35°19'40.0"N, 128°40'12.6"E (7 m)
6	Seoksan Landing Place, Junam Reservoir, Uchiang-gu, Changwon-si, Gyeongsangnam-do, Korea	35°18'48.1"N, 128°39'56.2"E (6 m)
7	Small ferry, 330 m upstream of Baegkok Bridge, Namgang River, Daesong-ri, Beopsu-myeon, Haman-gun, Gyeongsangnam-do, Korea	35°20'11.8"N, 128°21'44.3"E (17 m)
8	Daepyeong Marsh, Daesong-ri, Beopsu-myeon, Haman-gun, Gyeongsangnam-do, Korea	35°20'23.7"N, 128°20'09.4"E (11 m)

rea and the personal collections of S.J. Park, Suwon, Korea, T. Ito, Eniwa, Japan, and T. Nozaki, Kanagawa, Japan. The number of males and/or females, locality numbers (Table 1), collectors, and collecting methods are provided. The morphological terminology applied is indicated in the figure legends.

SYSTEMATIC ACCOUNTS

Order Trichoptera Kirby, 1813
 Family Hydroptilidae Stephens, 1836
 Genus *Hydroptila* Dalman, 1819

¹**Hydroptila dampfi* Ulmer, 1929 (Fig. 2A–F)

Hydroptila dampfi Ulmer, 1929: 264–266, figs. 10–12, male, Germany.

Hydroptila itoi Kobayashi, 1977: 5, 12, Pl. 4, male, female, Japan (Hokkaido). Synonymized by Ito et al. (2011).

Hydroptila sp.: Kumanski, 1990: 56–57, figs. 88–90, female, North Korea.

Material examined. 2♂♂, 1♀, Loc. 6, 25–26 May 2017, Park SJ, Nozaki T, light pan trap; 8♂♂, 3♀♀, Loc. 5, 25–26 May 2017, Park SJ, Nozaki T, light pan trap; 3♀♀, Loc. 8, 19–20 Oct 2016, Park SJ, Nozaki T, light trap.

Description. Male genitalia (Fig. 2A–D). Ventral process of

sternite VII short, apex subacute. Segment IX with largely convex anterior margin, short projection at posterodorsal corner and in lateral aspect irregularly protruded posterior margins. Dorsal plate semi-membranous, curved dorso-caudad in lateral aspect. Inferior appendages slender, gently curved dorso-caudad, in lateral aspect blunt protuberance at base. Phallic apparatus long, almost straight, with short titillator at middle.

Female genitalia (Fig. 2E, F). Segment VIII with large round sclerites laterally and transparent semicircular sternite ventrally. Segment IX with pair of round sclerites dorso-laterally, large sclerite ventro-laterally; ventral sclerite subquadrate with deep, wide concavity at posterior margin.

Distribution. Europe, the Russian Far East (Lake Khanka), China (Heilongjiang, Jiangsu, Henan), Japan (Hokkaido, Honshu), Korea.

Diagnosis and remarks. This species is widely distributed in Europe and Far East Asia and is now recorded from the Korean Peninsula for the first time. Adult males are clearly discriminated from those of other congeneric species by the slender inferior appendages and almost straight phallic apparatus and females by the 5 large sclerites of segments VIII–IX. The genitalic morphology of a female recorded as *Hydroptila* sp. from North Korea by Kumanski (1990) conforms with that of this species.

¹**Hydroptila introspinata* Zhou and Sun, 2009
(Fig. 2G–L)

Hydroptila introspinata Zhou and Sun in Zhou et al., 2009b: 906–908, 910–911, figs. 12–16, male, China (Heilongjiang).

Material examined. 5♂♂, Loc. 2, 23 May 2017, Park SJ, Nozaki T, light trap.

Description. Male genitalia (Fig. 2G–L). Sternite VII ventral process elongate, apex expanded and jagged. Segment IX with round anterolateral margin, short round processes posterolaterally. Dorsal plate membranous, subtriangular in lateral aspect, subquadrate in dorsal aspect, 4 pairs of thick spines ventrally; each basolateral process slender, directed ventro-caudad, apex acute. Subgenital plate trapezoidal, pair of papillae at postero-lateral corners in ventral view; papillae with long apical setae. Inferior appendages rod-shaped in lateral aspect, short setae dorso-apically and ventrally. Phallic apparatus long; slender titillator arises at mid-way, directed posteriad, apically subacute.

Female unknown.

Distribution. China (Heilongjiang), Korea.

Diagnosis and remarks. This species was described based

on male specimens collected from Heilongjiang, China, and here is recorded from the Korean Peninsula for the first time. In the shapes of the inferior appendages, dorsal plate, and phallic apparatus, males are similar to three Asian species: *Hydroptila pectinifera* Schmid, described from Mongolia (Schmid, 1970), *H. spinosa* Arefina and Armitage, found in the Russian Far East (Sakhalin) and Japan (Hokkaido, Honshu, Shikoku, Kyushu) (Arefina and Armitage, 2003; Ito et al., 2011), and *H. geniel* Malicky, described from Taiwan (Malicky, 2014). However, *H. introspinata* differs in having slender lateral processes which arise basolaterally from the dorsal plate and are directed ventro-caudad.

Genus *Orthotrichia* Eaton, 1873

²**Orthotrichia costalis* (Curtis, 1834) (Fig. 3A–C)

Hydroptila costalis Curtis, 1834: 218, male, Europe.

Orthotrichia tetensii Kolbe, 1887: 356–359, male, Germany. Synonymized by Neboiss (1963).

Orthotrichia costalis (Curtis): Malicky, 1983: 54–55, male, female, Europe.

Material examined. 2♀♀, Loc. 2, 23 May 2017, Park SJ, Nozaki T, light trap; 17♂♂, 24♀♀, Loc. 6, 25–26 May 2017, Park SJ, Nozaki T, light pan trap; 1♀, Loc. 5, 25–26 May 2017, Park SJ, Nozaki T, light pan trap; 2♀♀, Loc. 8, 25 May 2017, Park SJ, Nozaki T, light trap; 26♂♂, 47♀♀, Loc. 7, 25–26 May 2017, Park SJ, Nozaki T, light pan trap.

Description. Male genitalia (Fig. 3A, B). Segment VIII somewhat asymmetrical with postero-lateral corners protruded in ventral aspect. Segment IX asymmetrical, right postero-lateral process slender bar-like, apically acute, in ventral aspect left postero-lateral process slightly shorter than right one. Dorsal plate large, asymmetrical, leaf-like, cleft medially. Right inferior appendage bar-like, gently curved mesally, apically acute; left inferior appendage thick and robust, in ventral aspect short basoventral process and subapical protuberance. Phallic apparatus slender with ring-like titillator at middle.

Female genitalia (Fig. 3C). Segment VIII with pair of almond-shaped sclerotized plates ventrally. Segment X subquadrate apically, with pair of cerci.

Distribution. Europe, Russian Far East (Amur, Ussuri, Lake Khanka, Sakhalin), China (Shandong, Jiangsu, Henan, Hubei, Jiangxi, Guangxi, Hainan), Japan (Hokkaido, Honshu), Korea.

Diagnosis and remarks. This species was described originally from Europe and is also found in many localities of East Asia (Ito, 2013); this is the first record from the Korean

Korean name: ¹*팔가시에날도래 (신칭), ²*뿔애날도래 (신칭)

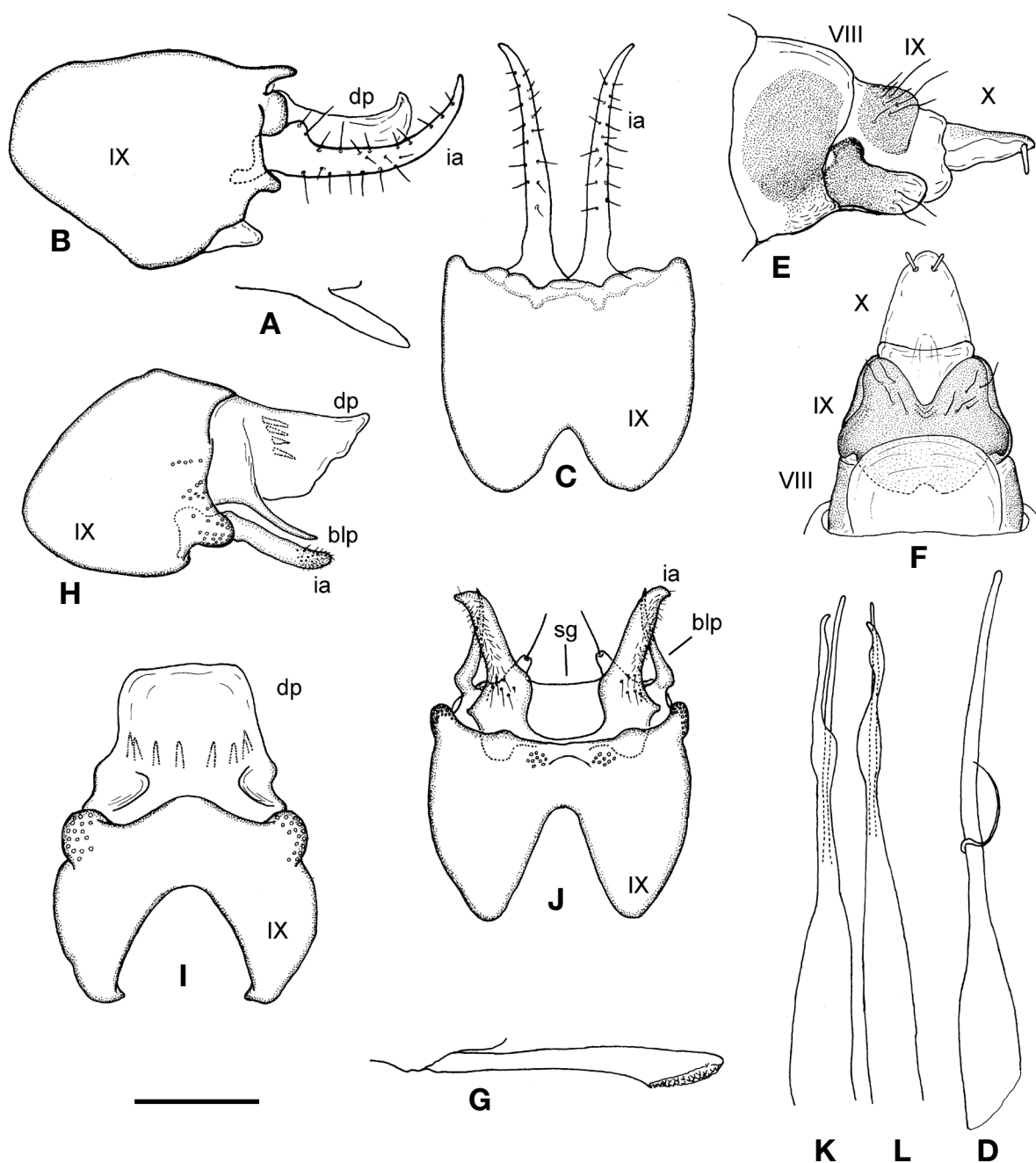


Fig. 2. Male and female of *Hydroptila dampfi* and male of *H. introspinata*. A-F, *Hydroptila dampfi*: A, Male, ventral process of sternite VII; B, Male genitalia, lateral; C, Same, ventral; D, Phallic apparatus, lateral; E, Female genitalia, lateral; F, Same, ventral. G-L, Male of *Hydroptila introspinata*: G, Ventral process of sternite VII; H, Genitalia, lateral; I, Same, dorsal; J, Same, ventral; K, Phallic apparatus, lateral; L, Same, ventral. VIII-X, abdominal segments VIII-X; blp, basolateral process; dp, dorsal plate; ia, inferior appendage; sg, subgenital plate. Scale bar=0.1 mm.

Peninsula. Males differ from other congeneric species by a combination of the asymmetrically protruded segment IX, the large membranous dorsal plate with a median cleft, and

the shape of inferior appendages.

¹**Orthotrichia tragetti* Mosely, 1930 (Fig. 3D-F)

Korean name: ¹*민숭애날도래 (신칭)

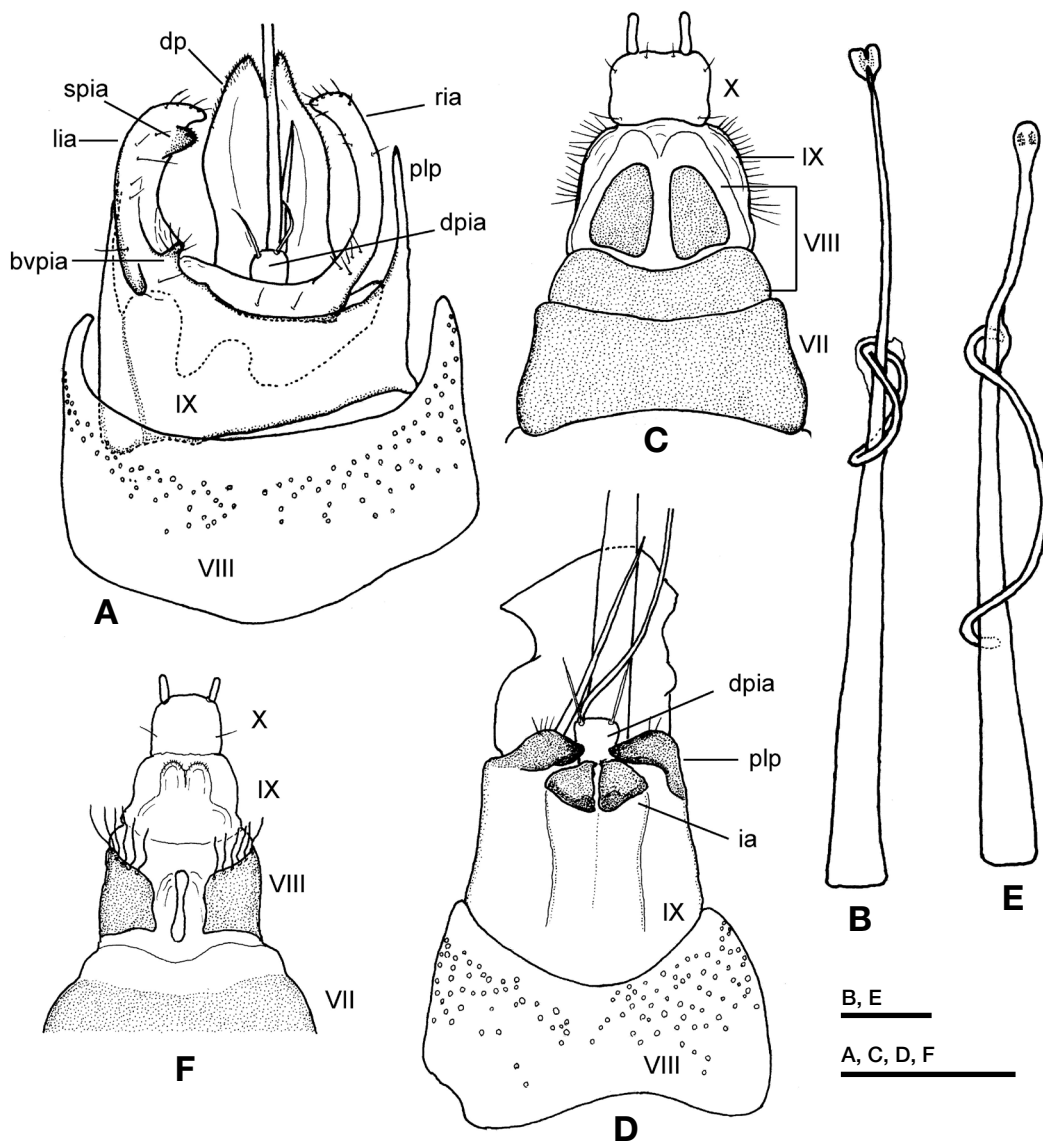


Fig. 3. Males and females of *Orthotrichia costalis* and *O. tragetti*. A–C, *Orthotrichia costalis*: A, Male genitalia, ventral; B, Phallic apparatus, ventral; C, Female genitalia, ventral. D–F, *Orthotrichia tragetti*: D, Male genitalia, ventral; E, Phallic apparatus, ventral; F, Female genitalia, ventral. VII–X, abdominal segments VII–X; bv pia, basoventral process of left inferior appendage; dp, dorsal plate; dpia, dorsal process of inferior appendage; ia, inferior appendage; lia, left inferior appendage; plp, posterolateral process of segment IX; ria, right inferior appendage; spia, subapical process of left inferior appendage. Scale bars=0.1 mm.

Orthotrichia tragetti Mosely, 1930: 237, 247–249, male, England.

Material examined. 130♂♂, 137♀♀, Loc. 6, 25–26 May 2017, Park SJ, Nozaki T, light pan trap; 105♂♂, 73♀♀, Loc. 5, 25–26 May 2017, Park SJ, Nozaki T, light pan trap; 2♀♀, Loc. 8, 25 May 2017, Park SJ, Nozaki T, light trap.

Description. Male genitalia (Fig. 3D, E). Segment IX somewhat asymmetrical, with strongly sclerotized postero-lateral processes; each process directed ventrad, truncate apically.

Dorsal plate large, semi membranous, asymmetrical in dorsal and ventral aspects, with sharp left projection subapically. Inferior appendage strongly sclerotized, very short. Phallic apparatus long, long titillator arising at middle.

Female genitalia (Fig. 3F). Segment VIII collar-like in ventral aspect, marginal setae strongly sinuous. Segment IX with pair of small lobes postero-ventrally. Segment X round to subquadrate in ventral aspect, pair of short cerci apically.

Distribution. Europe, Russian Far East (Amur, Ussuri, Lake Khanka, Vladivostok, Khasanski), China (Jiangsu, Henan,

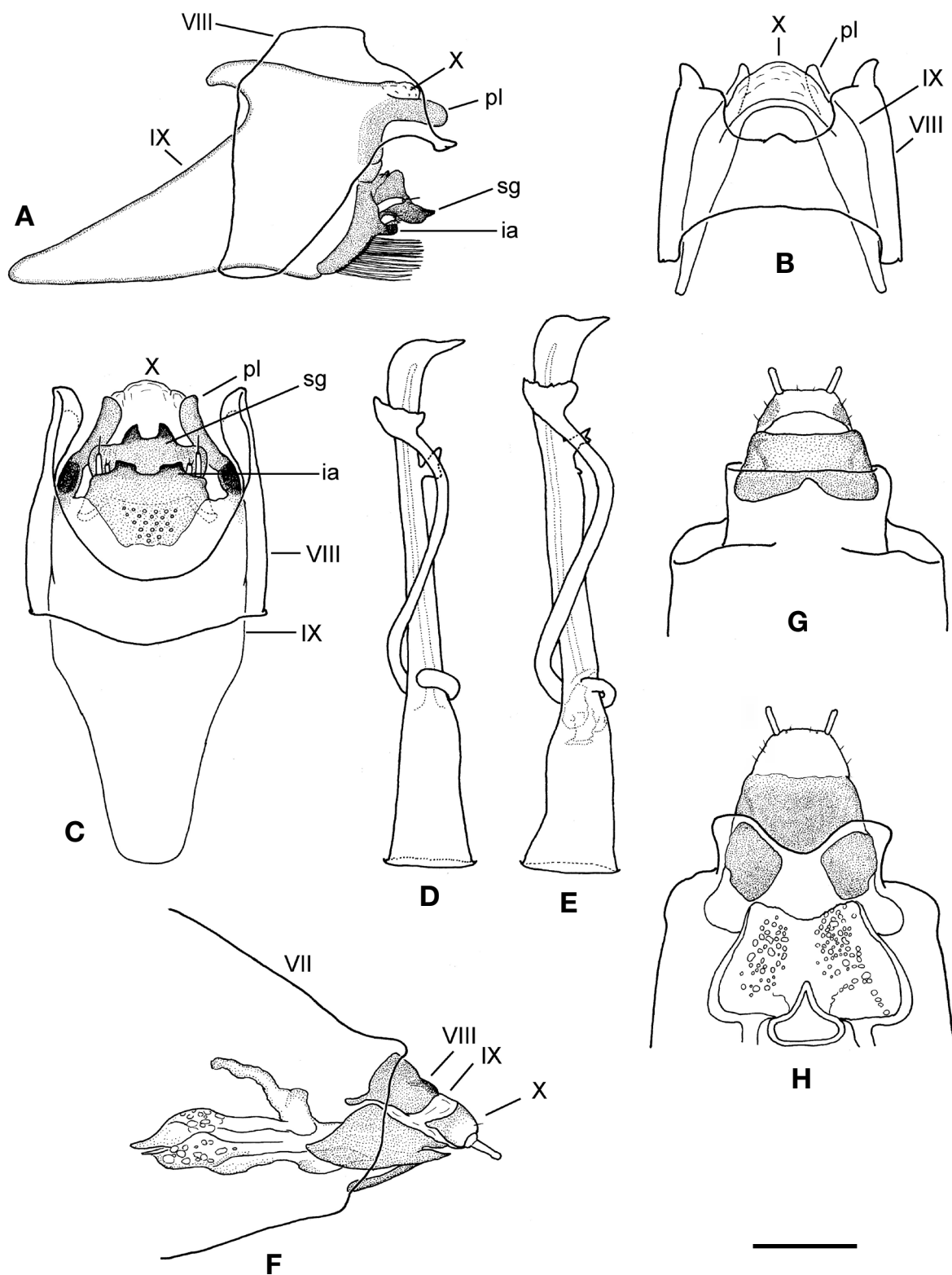


Fig. 4. Male and female of *Oxyethira miea*. A-E, Male: A, Genitalia, lateral; B, Same, dorsal; C, Same, ventral; D, E, Phallic apparatus, lateral. F-H, Female: F, Genitalia, lateral; G, Same, dorsal; H, Same, ventral. VII-X, abdominal segments VII-X; ia, inferior appendage; pl, postero-lateral lobe of segment IX; sg, subgenital plate. Scale bar=0.1 mm.

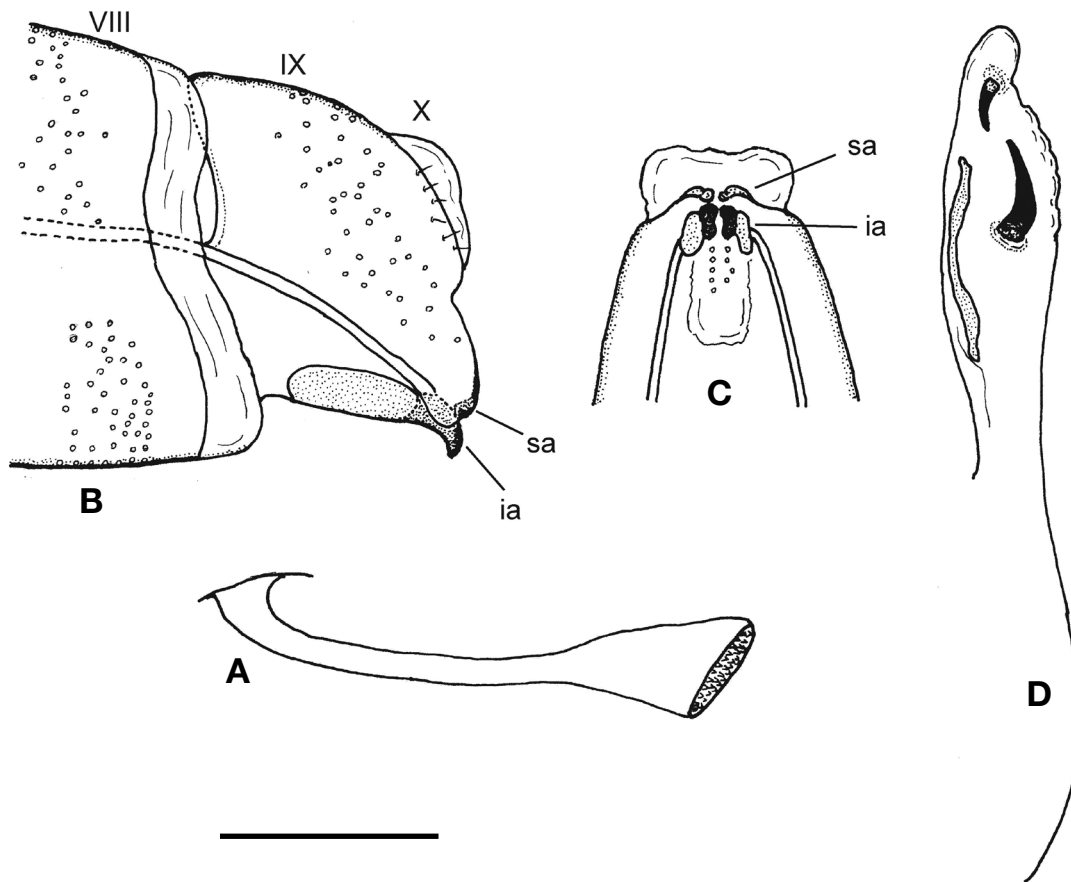


Fig. 5. Male of *Stactobia nishimotoi*. A, Ventral process of sternite VII; B, Genitalia, lateral; C, Same, ventral; D, Phallic apparatus, lateral. ia, inferior appendage; sa, subgenital appendage. Scale bar=0.1 mm.

Hubei), Vietnam, Japan (Hokkaido, Honshu, Kyushu, Amami-o-shima, Minami-daito-jima), Korea.

Diagnosis and remarks. This species was described originally from Europe and is also found in many localities of East Asia and Southeast Asia (Ito, 2013); this is the first record for the Korean Peninsula. The males are distinguished from other congeneric species by the combination of the strongly sclerotized postero-lateral processes of segment IX, the very short inferior appendages, and the large dorsal plate with a sharp left subapical protrusion.

¹*Genus *Oxyethira* Eaton, 1873

²**Oxyethira miea* Oláh and Ito, 2013 (Fig. 4)

Oxyethira miea Oláh and Ito, 2013: 42–43, figs. 53–56, male, Japan (Honshu); Ito and Oláh, 2017: 14–16, fig. 7, male, female, Japan (Hohshu).

Material examined. 12♂♂, 13♀♀, Loc. 2, 30 Aug 2015, Park SJ, Inaba S, light trap; 1♂, 45♀♀, Loc. 2, 19 Oct 2016, Park SJ, Nozaki T, light trap; 23♂♂, 58♀♀, Loc. 2, 23 May 2017, Park SJ, Nozaki T, light trap; 1♂, 5♀♀, Loc. 1, 23–24 May 2017, Park SJ, Nozaki T, light pan trap; 7♂♂, 57♀♀, Loc. 3, 30 Aug 2015, Park SJ, Inaba S, light pan trap.

Description. Male genitalia (Fig. 4A–E). Segment VIII annulate, with finger-like and obtuse processes at middle of posterior margin in lateral aspect. Segment IX produced anteroventrally, in lateral aspect forming triangular lobe; with short lobes anterodorsally and posterodorsally in lateral aspect; posterodorsal lobe plate-like in dorsal aspect. Segment X short, membranous. Subgenital plate well sclerotized, subtriangular in lateral aspect, short, apically truncate, pair of small triangular projections at middle in ventral aspect. Inferior appendages heavily sclerotized, fused to sternite IX at base, short, truncate, pair of short quadrate projections at middle and long stout setae in ventral aspect. Phallic appa-

Korean name: ¹*긴다리에날도래속 (신칭), ²*엄지애날도래 (신칭)

ratus long, thick, beak-shaped apically; small lateral process at apical 1/4, shapes variable individually; titillator arise from basal 1/3, broadened apically.

Female genitalia (Fig. 4F–H). Sternum VIII with pentagonal sclerites in ventral aspect, two ellipsoidal sclerites connected to sternite VIII postero-laterally. Segment IX membranous; tergite X weakly sclerotized.

Distribution. Japan (Honshu), Korea.

Diagnosis and remarks. This species was described originally from Japan (Honshu) (Oláh and Ito, 2013), and is recorded here from the Korean Peninsula for the first time. The male of this species is clearly discriminated from other congeners by the plate-like lobe on the postero-dorsal corner of segment IX, the short inferior appendage, the short truncate subgenital plate, and the shape of the phallic apparatus.

Genus *Stactobia* McLachlan, 1880

¹**Stactobia nishimotoi* Botosaneanu and Nozaki, 1996 (Fig. 5)

Stactobia nishimotoi Botosaneanu and Nozaki, 1996: 58–59, 61, figs. 15–18, male, Japan (Honshu); Ito, 2017: 218–219, fig. 10, male, Japan (Honshu, Shikoku, Kyushu, Yakushima).

Material examined. 4♂♂, Loc. 4, 21 May 2017, Nozaki T, swept.

Description. Male genitalia (Fig. 5A–D). Ventral process of sternite VII longer than sternite VII, spiny apex expanded. Tergite IX with long anterior apodeme, sternite IX lost. Segment X semi-membranous. Subgenital appendages thin, each mesal edge round in ventral aspect. Inferior appendages ventrally reduced to small, ellipsoidal lobes. Phallic apparatus long, rounded apically with slender sclerotized band and two short internal spines; spines strongly sclerotized, proximal spine long, gently curved, directed posteriad; apical spine shorter, slightly curved, directed anteriad.

Distribution. Japan (Honshu, Shikoku, Kyushu, Yakushima), Korea.

Diagnosis and remarks. This species was described originally from Japan (Honshu); its known distribution is now extended to the Korean Peninsula. Males of this species are clearly distinguished from those of other congeneric species by the two short spines of the phallic apparatus.

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